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Howard J. Wall and Gylfi Zoega

Recent work has suggested the possibility that the Beveridge curve can shift over the business cycle. This is in contrast with a large body of literature claiming that Beveridge curves have shifted due to structural changes alone. To test these claims, we use county-level data to estimate the timing and magnitude of shifts in aggregate and regional British Beveridge curves. We find that these shifts coincide with the business cycle rather than with hysteresis effects or with changes in regional mismatch. This implies that the Beveridge curve is a flawed device for separating the effects of structural changes from those of the business cycle.

A standard observation of the UK unemployment experience during the period from the late 1970s until the mid-1990s was a stable rate of inflow and a falling rate of outflow (Pissarides, 1986; and Bean, 1994). The trend in the outflow rate is consistent with increased mismatch, increased choosiness by firms, the discouraged worker effect, the loss of human capital by unemployed workers, and active labour-market policies. It is often thought to be manifested as an outward shift of unemployment/vacancy rate (*u/v)* combinations throughout the 1980s and early 1990s (Layard et al., 1991). Figure 1 illustrates this pattern for Britain.

The theoretical construct usually employed to analyse changes in a country's *u/v* plot is the Beveridge curve, defined as the downward-sloping locus of an economy's equilibrium *u/v* combinations. The starting point for deriving a Beveridge curve is a matching function, which can be written as:

$$M = M(U,V) \quad M_U > 0,\ M_V > 0; \tag{1}$$

where M denotes the number of hires or job matches, U the number of unemployed workers and V the number of vacancies. The matching function summarises the effectiveness of the technology that brings workers searching for jobs together with employers searching for workers. The idea behind this relationship is simple as well as intuitive: As the number of employers searching for workers and the number of workers searching for jobs rises, the number of hires should also go up. A large economy should thus have more hires over a given period of time simply because there are more firms and workers searching in its labour market.[1]

Specifying a Cobb-Douglas matching function exhibiting constant returns to scale,[2] (1) becomes

$$M = AU^{\gamma}V^{1-\gamma}. \tag{1'}$$

In equilibrium, the number of separations S equals the number of matches M. Applying this and dividing through by the size of the workforce L, (1') becomes

$$S/L = A\left(U/L\right)^{\gamma}\left(V/L\right)^{1-\gamma}. \tag{1''}$$

This can be written in log form as

$$\ln(s) = A + \gamma\ln(u) + (1-\gamma)\ln(v); \tag{2}$$

where s is the separation rate S/L, u is the unemployment rate U/L, v is the vacancy rate V/L, and A is the intercept. With a fixed separation rate and intercept, the implicit Beveridge curve (2) yields a negative relationship between the unemployment rate and the vacancy rate.

In steady state movements along a fixed Beveridge curve are meant to occur over the business cycle as vacancies open and close and workers exit or enter the ranks of the unemployed. Shifts of the Beveridge curve—changes in the matching technology parameter A—are presumed to be due structural changes reflecting the ability of the unemployed to be matched to vacancies. These changes can be in search effort, search effectiveness, or the characteristics of the pool of unemployed workers. There may also be a hysteresis effect

[1] See Petrongolo and Pissarides (2001) for a survey of matching functions and the Beveridge curve.
[2] The matching function can be expressed in rates only if it exhibits constant returns to scale, which has been found to be the case by Pissarides (1986), Blanchard and Diamond (1989), and Coles and Smith (1996), although the issue is by no means settled (see Baker, Hogan, and Ragan, 1996).

whereby a movement along a current Beveridge curve induces an outward shift of the next period's Beveridge curve because long spells of unemployment may make the unemployed less likely to find employment. This can be caused by such things as a deterioration of the human capital of the unemployed (Okun, 1973; Layard and Bean, 1989; and Pissarides, 1992), the search ability of the unemployed (Layard and Nickell, 1987), or a negative perception of the unemployed on the part of potential employers (Blanchard and Diamond, 1994).[3]

Because of the convexity of the matching function, mismatches in sub-markets—regions, industries, or worker types—can also shift the aggregate Beveridge curve. For example, starting from a position of no mismatch, if two such sub-markets move in opposite directions along their fixed Beveridge curves, increasing the sub-market mismatch, the aggregate Beveridge curve will shift outward.[4,5]

The movements of the British *u/v* combinations illustrated by Figure 1 are often said to indicate shifts of the steady-state British Beveridge curve, and much of the debate about the British experience has centred on the causes of these supposed shifts. Most prominently, Jackman, Layard, and Savouri (1991) argue that these shifts cannot be explained by an increase in mismatch, and hence must be due to structural changes.[6] More precisely, they have attributed these shifts to hysteresis effects, arising from the deleterious effects that unemployment spells have on the search-effectiveness of the unemployed. The presumed

[3] Microeconomic studies provide corroborating evidence for this hypothesis. Thus an adverse effect of unemployment on workers' psychological health has been found by Warr (1987) and Heady and Smith (1989), and adverse effect on workers' motivation by Banks and Jackson (1982).
[4] See Abraham (1987), who calls this the divergence hypothesis.
[5] This assumes that the submarkets start from a position of no mismatch. More generally, when mismatch is already present, movements in opposite directions can increase or decrease mismatch.
[6] See also Jackman and Roper (1987) and Budd, Levine, and Smith (1987).

shifts of the British Beveridge curve have provided probably the most important macroeconomic evidence for this type of unemployment hysteresis. The following is a good example of this line of thinking:

> In wage equations long-term unemployment is usually found to have a very small (or zero) effect in reducing wage pressure. The reasons for this are obvious: long-term unemployed people are not good fillers of vacancies. This can be seen from data on exit rates from unemployment: exit rates decline sharply as duration increases. Equally, aggregate time series show that, for a given level of unemployment, vacancies increase the higher the proportion of unemployed who are long-term unemployed. (Layard, 1997).

In contrast to this traditional interpretation, other work has suggested that the Beveridge curve may instead shift over the business cycle. Bowden (1980) demonstrates how an anticlockwise movement of the u/v combinations (in vacancy-unemployment space) traces out an adjustment path towards a steady state when vacancies adjust more rapidly than unemployment. Coles and Smith (1995) and Gregg and Petrongolo (1997) claim that it is misleading to use the stocks of vacancies and of the unemployed because the stocks of vacancies may be better matched by the flows of the unemployed, and the flow of vacancies may be better matched by the stock of the unemployed. Baker, Hogan, and Ragan (1996) argue that the matching function, on which the Beveridge curve is based, ignores the effects of on-the-job search. If the amount of on-the-job search changes over the business cycle, the Beveridge curve will shift.

Although the literature places a great deal of significance on shifts of Beveridge curves, there is a relative paucity of work that actually estimates when these shifts occur.[7] Our objective in this paper is to estimate recent shifts in the British Beveridge curve, and to

[7] Estimates of matching functions are much more numerous. See Blanchard and Diamond (1989), Coles and Smith (1996), Baker, Hogan, and Ragan (1996), and the studies they cite.

examine the extent to which these shifts can be attributed to structural changes in the matching process, or to fluctuations in the business cycle.

Section I describes the various approaches that have been used to estimate Beveridge curves. In section II we estimate both the aggregate and the regional Beveridge curves for 1986-95 using county-level data, and derive a time path for the effect of all unobserved variables working to shift the curves. Section III looks at possible causes, both structural and cyclical, for the shifts in the estimated Beveridge curves. In Section IV we estimate and discuss the shifts of the Beveridge curve from 1971-95 using only regional-level data. Section V concludes.

I. Estimating Beveridge Curves

The major difficulty in estimating Beveridge curves is that shifts over time are difficult to detect non-arbitrarily because there is only one observation per period. Although steps are usually taken to try to control for this, almost none are satisfactory in separating shifts of the Beveridge curve from movements along it. Perhaps because of this, estimation is sometimes avoided altogether in favour of nothing more sophisticated than a visual inspection of the relationship, as in Jackman, Pissarides, and Savouri (1990), Bean (1994), and Gregg and Petrongolo (1997). Along these lines, Gärtner (1997, p. 311) simply draws arbitrary curves to connect points that, in his opinion, lie on the same Beveridge curve.

When Beveridge curves are estimated more formally, shifts are usually controlled for with a quadratic time trend.[8] Because this restricts the shifts of the curve to following a particular functional form, it is of limited use. Another option, pursued by Gregg and

[8] Layard, Nickell, and Jackman (1991, 267-269), and Blanchard and Diamond (1989) are standard.

Petrongolo (1997), is to divide the sample into time blocks whose length and number are chosen in advance according to a visual inspection of the *u*/*v* time plot. All periods in a time block are then assumed to lie on the same Beveridge curve, and time dummies are constructed accordingly. While this method has its advantages, it nevertheless imposes the shifts of the Beveridge curve over time, instead of estimating them.

Börsch-Supan (1991) developed a useful and relatively simple panel approach that uses regional-level data to estimate aggregate Beveridge curves. The advantage of the panel approach is that because there are as many observations per period as there are regions. With enough regions, there are enough observations per year to estimate yearly dummy variables, indicating the position—and, therefore, the shifts—of the Beveridge curve for every period. A straightforward and desirable extension would be to extend this logic to estimate regional Beveridge curves using data from the next level of disaggregation. Having regional Beveridge curves allows for an examination of the underlying regional changes driving the shifts of the aggregate Beveridge curve and an estimation of the degree of regional mismatch.

Because Börsch-Supan was applying his model to Germany, and the appropriate data were unavailable for German sub-regions, he was unable to estimate regional Beveridge curves in the same way.[9] However, estimates of regional Beveridge curves are necessary in order to separate the effects of regional mismatch. Fortunately, though, these data are available for the UK, and these series are now long enough to allow for an examination of this sort. We use county-level data for 1986-96 to estimate a Beveridge curves for each of

[9] Because of these data limitations, he instead assumed that the years in which he estimated that the aggregate Beveridge curve shifted were the same years in which each of the regional curves shifted.

the ten standard regions of Britain, and for Britain as a whole.[10] With these estimates we are able to determine the extent to which shifts in the aggregate curve are caused by shifts of regional curves or by regional mismatch.

A disadvantage of the panel approach is that, for reasons of data availability it is necessary in most cases to make the strong assumption that the labour market is always in steady state. Alternatively, if data on the number of new hires are available, the matching function can be estimated directly without having to assume the steady state, as in Blanchard and Diamond (1989), who estimated the aggregate US Beveridge curve with aggregate-level data. Because the panel approach relies on data from lower levels of aggregation, and data on new hires at the county or regional level in the UK do not exist, we must rely on the steady-state assumption, as did Börsch-Supan for Germany. Below, we examine the validity of this assumption, and the implications for using Beveridge curves as evidence of structural changes in British labour markets.

II. The Empirical Model

We use the Beveridge curve given by equation (2) to derive our regression equation. Holding the separation rate constant and rearranging (2), the regression equation we estimate is:

$$\ln(u_{it}) = \alpha_i + \tau_t D + \beta \ln(v_{it}) + \varepsilon_{it}; \qquad (2')$$

[10] Courtney (1991) for the US and Jones and Manning (1992) for the UK also estimate regional Beveridge curves and use them to examine the importance of regional labour market dynamics on the aggregate Beveridge curve. Both of these simply use a quadratic time trend to control for shifts of the curves.

where α_i is a county-specific fixed effect, D is a vector of year dummy variables, τ_t is the coefficient on the dummy variable for year t, $\beta = (\gamma - 1)/\gamma$, and ε_{it} is the error term for county i, year t. Our main interest is in the signs and magnitudes of the yearly shifts of the Beveridge curves, which are measured by the year-to-year differences in the coefficients on the time dummies.

We use yearly county-level data on the unemployment and vacancy rates for the counties of England, Wales, and Scotland for 1986-1996.[11] Unemployment and vacancy rates are percentages of the workforce; unemployment data are taken from various issues of the Employment Gazette; and vacancy and workforce data are from NOMIS.[12]

To estimate the aggregate Beveridge curve, we pooled the data for all 65 counties, using the county-specific fixed effects to control for county heterogeneity. To estimate each of the ten regional Beveridge curves, we used data only from the region's counties. So as to avoid collinearity, the dummy for 1986 was excluded, meaning that the estimated time dummy provides the position of a Beveridge curve relative to that of 1986. The results of these regressions are summarised by Table 1 (note that the estimated county-specific effects are not reported here).

Aggregate Beveridge curve

First focusing on the aggregate Beveridge curve, notice that, as expected, we find a negative relationship between the vacancy and unemployment rates when time effects are controlled for. However, we find the Beveridge curve to be much steeper than has the

[11] The county of Surrey is not included because it does not satisfy the self-containment criteria for a local labour market, and, hence, the data are not collected.
[12] Note that data on vacancies for counties in Wales and Scotland were unavailable for 1996.

previous literature, which tended to find that $\hat{\beta} \cong 1.0$ (Jackman, Layard, and Savouri, 1991, p. 89). This would indicate that along a fixed Beveridge curve, a 10% increase in the number of unemployed tends to be accompanied by a 10% decrease in the number of vacancies. In contrast, from our estimates one would predict vacancies to be 50% lower. This difference is important because Jackman, Layard, and Savouri (1991) need to assume that $\beta = 1$ to construct their index of regional mismatch, which would take a very different form under different assumptions about the slope.

More important than the slope of the Beveridge curve are its shifts over time, which are measured by the differences in the year dummies. As summarised by the first column in Table 2, and taking the significance level to be 10%, the aggregate Beveridge curve shifted every year from 1987 to 1996. It shifted inwards from 1987 to 1989, outwards from 1990 to 1993, and back inwards until 1996. A visual inspection of Figure 1 might lead one to see a relatively flat Beveridge curve that shifted less frequently during this period, with movements along a fixed curve in 1986-1987, 1990-92, and 1993-1995.[13] However, we have instead found a relatively steep Beveridge curve that shifted every year. We will examine the significance of this in the next section, in which we try to separate these shifts into their components.

Regional Beveridge curves

Moving to the estimates of the regional Beveridge curves, note that according to the first row of Table 1, the estimated slopes are negative for only four of them, although for none of the regions were they statistically different from zero. This is not surprising given

[13] In fact, Gregg and Petrongolo (1997) assume a single Beveridge curve for 1988-1995.

the lack of degrees of freedom at the regional level: for each region the number of independent variables is eleven plus the number of counties. However, given the low number of counties in some regions, it is surprising that nearly all of the year dummies we estimated were statistically significant.

In terms of detecting shifts in regional Beveridge curves, our estimation is very successful. As summarised by Table 2, our estimates indicate that the ten regional Beveridge curves shifted to a statistically significant extent nearly as often as the aggregate Beveridge curve. Also, note that for most years the shifts of the regional Beveridge curves concurred with those at the aggregate level. The notable exception was 1990, during which the Beveridge curves of the Southern regions shifted out, but those of all other regions shifted in, resulting in an outward shift at the aggregate level.

Of course, these results are only as good as the data, and there are numerous potential problems with vacancy data. In particular, the share of total vacancies reported to Job Centres rose through the 1970s and early 1980s, which, if it continued, would bias our results towards finding outward shifts of the Beveridge curve. To test for this, we rescaled our vacancy data using an adjustment ratio based on Jackman, Layard, and Pissarides (1989). This adjustment ratio is based on the assumption that the ratio of the stocks of Job Centre vacancies to actual vacancies is the same as the ratio of the flows. We multiplied our vacancy rates by the ratio of vacancies filled through Job Centres to total engagements. Because we only have this data at the regional level, we used the same adjustment ratio for all counties within a region in a given year. The estimated shifts of the Beveridge curve using these rescaled vacancy rates were fundamentally no different from those summarised above, so we conclude that the frequent shifts we estimated are not due to changes in the rates at which vacancies have been reported to Job Centres.

III. Why Did the British Beveridge Curve Shift?

In the previous section we estimated the shifts of regional and aggregate Beveridge curves without discussing the causes of the shifts we detected. In this section we address the extent to which regional mismatch, changes in the characteristics of the unemployed, and unemployment hysteresis have been responsible for these shifts.

As a preface, refer to Figure 3, which plots our estimated shifts of the aggregate Beveridge curve along with yearly percent changes in the Index of Production (IoP) produced by the Office of National Statistics, which indicates fluctuations of the business cycle.[14] Although fluctuations in the business cycle are meant to result in movements along fixed Beveridge curves, it is clear from Figure 3 that the shifts of the aggregate Beveridge curve occur in sync with changes in the IOP. This result is also easily obtained with other measures of the business cycle, such as the output gap, which also moves in sync with the Beveridge curve.[15]

The conclusion to draw from Figure 3 is that the Beveridge curve is not terribly useful for representing the extent of structural changes in the British labour market over the period. This echoes Blanchard and Diamond (1989) who posit that much of the movement of the *u/v*

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[14] Care must be taken when choosing an indicator for the British business cycle. For our purposes, we need an indicator that reflects changes in the aggregate demand for labour, such as the IoP, which is highly correlated with the unemployment rate.

[15] The output gap is the difference between trend real GDP, which we obtain with a Hodrick-Prescott filter, and actual real GDP.

plot in the US has been due to movements of the business cycle, and not to structural changes in the labour market. However, Figure 3 is not conclusive because the cyclicality of the *u/v* plot might also mean that level of mismatch is itself related to the business cycle. For example, if the business cycle affects regions differently, then the level of regional mismatch can change over the business cycle, thus shifting the aggregate Beveridge curve. If so, then it is necessary to first eliminate the effects of regional mismatch from the aggregate shifts we have detected.

Regional mismatch

To determine the importance of changes in regional mismatch on the shifts of the aggregate Beveridge curve, we first calculate the hypothetical shifts of the aggregate Beveridge curve that would have occurred in the absence of regional mismatch. These are the shifts of the aggregate Beveridge curve that would have occurred due only to shifts of the regional Beveridge curves. Under the assumption of constant returns to scale, these hypothetical shifts can be measured by the sum of the regional shifts weighted by the regions' shares of the labour force.

Table 3 provides these total estimated shifts of the aggregate Beveridge curve (the change in the year dummies over time), the shifts that would have occurred with constant regional mismatch (weighted sum of shifts of regional Beveridge curves), and the shifts of the Beveridge curve due to changes in regional mismatch (the first column minus the second). Note that, in absolute terms, changes in regional mismatch were not responsible for sizeable shifts in the aggregate Beveridge curve, although for some years it was relatively important. To measure the relative importance of changes in regional mismatch the fourth column of Table 3 provides the ratio of the absolute values of the shift due to changes in regional mismatch, and the total shift of the aggregate Beveridge curve.

Looking at Figure 4, which plots the information from Table 3, one can see the relative and absolute sizes of the shift of the aggregate Beveridge curve that are due to changes in regional mismatch, and that are due to shifting regional Beveridge curves. Note that, as discussed above, the intercepts of the aggregate and regional Beveridge curves shifted in tandem with the unemployment rate, whereas, the level of regional mismatch moved in opposition to it. When the aggregate and regional Beveridge curves shifted in during the late 1980s and mid 1990s, regional mismatch was rising. When they were shifting out in the early 1990s, regional mismatch was falling. This is consistent with the regional incidence of the business cycle during this period. The expansion of the late 1980s and the recession of the early 1990s affected the South to a greater extent than it did elsewhere. So, although changes in regional mismatch were relatively important in some years, they cannot explain the apparent cyclicality of the aggregate Beveridge curve.[16] In fact, they appear to instead work against it, although there are too few years to say much about the generality of this result.

Search effectiveness and unemployment hysteresis

Two other structural explanations for the shifting Beveridge curve are unemployment hysteresis and autonomous changes in the search-effectiveness of the unemployed. The former is normally measured by changes in the share of the unemployed who have been

[16] These results confirm the earlier finding of Jackman and Roper (1987).

unemployed for longer than one year, and the latter by changes in various characteristics of the unemployed such as age, sex, and education.

To estimate the importance of these factors in determining the position of the regional Beveridge curves, we created a panel with our estimated intercepts of the regional Beveridge curves as the dependent variable. Specifically, we estimated

$$\hat{\tau}_{jt} = \omega_j + \delta u_{jt} + \rho L_{jt} + \lambda' \mathbf{Z_{jt}} + \eta_{jt}; \tag{3}$$

where ω_j is a regional fixed effect and L_{jt} is the change in share of the unemployed who have been unemployed for longer than one year. The vector $\mathbf{Z}_{jt}$ measures changes in the characteristics of the unemployed, and includes the changes in the shares of the unemployed who were: males under 20 years old, females under 20, males over 50, and females over 50. Unfortunately, because regional-level data on the education of the unemployed exist only from 1992, we are unable to include education in $\mathbf{Z}_{jt}$. Finally, we include the unemployment rate in (3) to control for the business cycle because the IoP is unavailable at the regional level. To make them consistent with our estimated regional intercepts, we measure all variables as differences from their 1986 levels.

The OLS results are summarised in Table 4, which omits the estimated fixed effects. The rate of long-term unemployment is positively related to the intercepts of the regional Beveridge curves, indicating the statistical significance of unemployment hysteresis. The variables measuring the composition of the unemployment pool were also related to the positions of the regional Beveridge curves, although to varying degrees of statistical significance. Increases in the proportion of the unemployed who are males under 20 appear to shift the Beveridge curves outward. However, increases in the proportions of females under 20 and of males and females over 50 appear to have the opposite effect.

Although we find that unemployment hysteresis has had a statistically significant effect on the movement of the aggregate Beveridge curve, we find no evidence that the movements over this period can be attributed to any great extent to hysteresis. Using the estimated coefficient on the long-term unemployment rate, we calculated the intercepts of the regional Beveridge curves that would have occurred if regional long-term unemployment rates had not changed from their 1986 levels. The weighted sum of these hypothetical regional intercepts yields the intercept for the aggregate Beveridge curve if there had been no regional mismatch and no unemployment hysteresis.

The relative *un*importance of unemployment hysteresis is illustrated by Figure 5, which contains the plots of two hypothetical intercepts of the aggregate Beveridge curve: one with no regional mismatch, and the other with no regional mismatch and no unemployment hysteresis. As illustrated, although the intercepts would have been lower in the absence of hysteresis, the cyclicality of the intercepts is unaffected. Thus, contrary to the contention of Jackman *et al* (1991), we find little evidence to show that the *u*/*v* plot illustrated by Figure 1 is driven by unemployment hysteresis.

Our analysis so far may be subject to one important criticism. In the absence of any shifts of the steady-state Beveridge curve, the unemployment-vacancy plot may move in an anti-clockwise loop around a constant or fixed Beveridge curve over the business cycle due to the cost of hiring and firing workers. The question then arises whether our estimated shifts reflect such loops, which are compatible with a constant trade off between vacancies and unemployment. Potentially, this could explain the significance of the unemployment rate in the estimation reported in Table 4. A standard approach to the modeling of such lagged adjustment processes is to include a function of time in the dynamic model or to use time dummies as has been done in this paper. We can now use our estimated time dummies to test whether the shifts reflect counter-cyclical loops around a fixed Beveridge curve, one the one hand, or, on the other hand, shifts of the Beveridge curve itself over the business cycle. We test the two hypotheses in Table 4 by including both current and lagged unemployment in the regression. As shown in Table 4, the addition of lagged unemployment had no statistically relevant effect on the results while the current unemployment rate has a significant, positive coefficient. We conclude that the shifts in the Beveridge curves were due to current unemployment, not past unemployment.

IV. The Beveridge Curve for 1971-1995

Up to this point, because of data limitations we have been unable to say anything about the movement of the *u/v* combinations in the turbulent years of the 1970s and early 1980s. As illustrated by Figure 1, during 1975-85 there was an almost continual outward movement of the *u/v* plot along the unemployment axis, with relatively small changes in the corresponding vacancy rates. As this is the period most often discussed in the literature, it would be instructive to compare the shifts estimated using the panel data methodology to those of previous studies. Unfortunately, because county-level data were not collected for the period before 1986, we cannot perform a complete analysis that includes an examination of regional mismatch. Nonetheless, we can use regional-level data to estimate the shifts of the national Beveridge curve, and then see how well the estimated shifts correspond to the business cycle. This is a straightforward application of Börsch-Supan (1991) to British data.

As with our earlier estimation, the regression equation for the aggregate Beveridge curve is (2'), except that the unit of observation is the region, meaning that α_i is a region-specific fixed effect, and ε_{it} is the error term for region *i*, year *t*. The data for 1971-95 were collected from various issues of *Regional Trends*, although inexplicably, data for 1979 are unavailable. To avoid collinearity, the time dummy for 1971 was excluded, meaning that the estimated time dummies provide the position of the Beveridge curve relative to that of 1971. The results of the estimation are summarised by Table 5.

As with our previous estimates of the slope of the British Beveridge curve that used county-level data, we find a much steeper curve in *v-u* space (low $\hat{\beta}$) than do previous studies. As we noted above, according to Jackman, Layard, and Savouri (1991), a 10% increase in the number of unemployed would tend to be accompanied by a 10% decrease in the number of vacancies (i.e., $\hat{\beta} = 1$). According to our estimates, however, there should be an accompanying decrease in vacancies of 30%. This is further evidence that the index of regional mismatch used by Jackman, Layard, and Savouri (1991), which is predicated on their estimate of β being equal to one, is probably not useful.

The occurrence and direction of shifts of the Beveridge curve that we detect are indicated by the fourth column of Table 5. Taking a statistical significance level greater than 90% to mean that a shift occurred, we find that the British Beveridge curve shifted frequently, and usually to the right, during the period 1971-82. Its position was then unchanged during 1982-87, and it then drifted back to the left during the late 1980s, before shifting out again in the early 1990s.

Contrast this with previous work that relied on visual inspections of the *u/v* plot to detect shifts in the Beveridge curve. For 1971-80, Jackman, Layard, and Pissarides (1989) see only one shift (in 1976); whereas we detect six. For the 1980s, Jackman, Pissarides, and Savouri (1990) interpret all of the movement during the period as occurring along a single fixed Beveridge curve, whereas we detect five different Beveridge curves. For 1971-95, Gregg and Petrongolo (1997) saw only three shifts (1974, 1979, and 1988); whereas we detect fourteen.

Recall that shifts of the Beveridge curve are meant to represent either regional mismatch or changes in the search effectiveness of the unemployed, and that movements of the business cycle are meant to be reflected in shifts along a fixed Beveridge curve. Refer to Figure 6, which shows how the Beveridge curve tended to shift outwards when the IoP declined, and vice versa.[17] As with our analysis above for our results with county-level data for 1985-96, we take this as evidence that shifts in the Beveridge curve are driven by the business cycle, and not by structural changes. We conclude that, as with 1985-96, the large outward movement of the *u/v* plot that occurred during the 1970s and early 1980s does not provide much evidence of changes in search-effectiveness.

V. Concluding Remarks

The Beveridge curve, which is the standard theoretical construct for explaining a country's *u/v* plot, is a flawed device for separating the effects of structural changes from fluctuations of the business cycle. This can be due to problems in the underlying theoretical framework and/or to empirical difficulties in identifying the different shocks.

[17] The same result can be obtained using the output gap instead of the IoP, as with Figure 3.

We have gone a step further than previous work on the British Beveridge curve, but our methodology still shares some of the literature's shortcomings. Out of necessity, we have assumed that structural changes are shared by all counties in a given region and that they only affect the position of the Beveridge curve and not its slope. This is nevertheless less restrictive than previous work, which implicitly assumes that structural changes and slopes are uniform across all geographic units within a country. Also, as with all previous work, with the exception of Börsch-Supan (1991), we present results for the log-linear specification of the Beveridge curve. Because the issue of specification error is bound to arise we should mention that we have also used Börsch-Supan's specification in which the unemployment rate is inversely related to the vacancy rate, and have obtained nearly identical general results.

Keeping these empirical issues in mind, our results are consistent with Bowden (1980), Coles and Smith (1995), and Gregg and Petrongolo (1997) who argue that the position of the Beveridge curve can be related to the business cycle, and not solely to structural variables. We conclude that one should hesitate before using arguments based on the Beveridge curve to explain the recent persistence of high unemployment in Britain. Although this persistence may in fact be caused by unemployment hysteresis, as is often argued, but the British *u/v* experience appears to provide little evidence of this.

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Table 1

Regression results: Dependent variable = log of unemployment rate; county dummies not reported

	Britain	North	York. & Humb.	East Midlands	East Anglia	South East	South West	West Midlands	North West	Wales	Scotland
vacancy	-0.196*	0.130	-0.078	-0.175	0.075	0.009	0.172	0.099	-0.012	-0.030	0.0004
rate	(.039)	(.128)	(.086)	(.110)	(.223)	(.053)	(.110)	(.082)	(.105)	(.051)	(.055)
1987	-0.135	-0.111	-0.121	-0.140	-0.197	-0.204	-0.188	-0.154	-0.127	-0.133	-0.035
	(.027)	(.050)	(.037)	(.056)	(.055)	(.042)	(.040)	(.044)	(.039)	(.029)	(.036)
1988	-0.351	-0.322	-0.315	-0.338	-0.588	-0.598	-0.546	-0.497	-0.330	-0.339	-0.220
	(.029)	(.061)	(.046)	(.065)	(.096)	(.042)	(.049)	(.054)	(.056)	(.032)	(.038)
1989	-0.687	-0.575	-0.601	-0.668	-0.995	-0.982	-0.900	-0.900	-0.591	-0.704	-0.484
	(.029)	(.074)	(.049)	(.064)	(.073)	(.042)	(.042)	(.051)	(.063)	(.033)	(.039)
1990	-0.822	-0.703	-0.720	-0.816	-0.894	-0.921	-0.807	-0.976	-0.723	-0.825	-0.641
	(.028)	(.056)	(.038)	(.057)	(.058)	(.484)	(.057)	(.043)	(.038)	(.029)	(.037)
1991	-0.496	-0.476	-0.513	-0.441	-0.419	-0.258	-0.247	-0.522	-0.488	-0.542	-0.549
	(.029)	(.050)	(.039)	(.059)	(.093)	(.052)	(.073)	(.048)	(.040)	(.030)	(.036)
1992	-0.313	-0.365	-0.376	-0.245	-0.164	0.048	-0.026	-0.266	-0.364	-0.432	-0.496
	(.029)	(.050)	(.039)	(.058)	(.097)	(.050)	(.065)	(.047)	(.039)	(.029)	(.036)
1993	-0.214	-0.376	-0.287	-0.136	-0.046	0.153	0.035	-0.229	-0.329	-0.352	-0.425
	(.028)	(.621)	(.037)	(.056)	(.077)	(.049)	(.052)	(.044)	(.039)	(.029)	(.036)
1994	-0.255	-0.468	-0.343	-0.192	-0.236	0.006	-0.178	-0.441	-0.441	-0.413	-0.433
	(.028)	(.063)	(.044)	(.061)	(.055)	(.043)	(.040)	(.050)	(.056)	(.035)	(.037)
1995	-0.384	-0.468	-0.417	-0.340	-0.363	-0.170	-0.357	-0.605	-0.556	-0.569	-0.561
	(.029)	(.063)	(.048)	(.063)	(.057)	(.042)	(.041)	(.054)	(.070)	(.036)	(.039)
1996	-0.601	-0.577	-0.586	-0.589	-0.541	-0.440	-0.521	-0.856	-0.726	-	-
	(.031)	(.053)	(.048)	(.057)	(.061)	(.044)	(.047)	(.045)	(.040)	-	-
counties	65	5	4	5	3	12	7	5	4	8	12
Obs.	692	54	43	55	33	132	76	55	44	80	120
R^2	0.881	0.960	0.987	0.942	.977	0.961	0.965	0.974	0.985	0.977	0.967
log-likel.	344.02	70.12	75.68	64.95	52.13	125.78	98.77	78.67	75.56	124.63	133.61

* - statistically significant at 5% level (used only for coefficient on the vacancy rate). Numbers in parentheses are standard errors.

Table 2
Shifts of the National and Regional Beveridge Curves

	Britain	*North*	*York. & Humb*	*East Midlands*	*East Anglia*	*South East*	*South West*	*West Midlands*	*North West*	*Wales*	*Scotland*
1987	←	←	←	←	←	←	←	←	←	←	=
1988	←	←	←	←	←	←	←	←	←	←	←
1989	←	←	←	←	←	←	←	←	←	←	←
1990	→	←	←	←	(→)	(→)	(→)	(←)	←	←	←
1991	→	→	→	→	→	→	→	→	→	→	(←)
1992	→	→	→	→	→	→	→	→	→	→	→
1993	→	→	→	→	→	→	→	=	=	→	→
1994	←	(←)	(←)	(←)	←	←	←	(←)	(←)	←	=
1995	←	(←)	←	←	←	←	←	←	←	←	←
1996	←	←	←	←	←	←	←	←	←		

=, significant at less than 80% level; ( ), significant at 80-90% level. All others significant at greater than 90% level.

Table 3
The extent of regional mismatch

	total shift of agg. Beveridge curve X	shift with constant regional mismatch Y	due to changes in regional mismatch X – Y	importance of regional mismatch $\|X-Y\|/\|X\|$
1987	-0.135	-0.157	0.022	0.163
1988	-0.216	-0.304	0.088	0.407
1989	-0.336	-0.342	0.006	0.018
1990	-0.135	-0.028	-0.107	0.793
1991	0.326	0.433	-0.107	0.328
1992	0.183	0.210	-0.027	0.148
1993	0.099	0.076	0.023	0.232
1994	-0.041	-0.122	0.081	1.976
1995	-0.129	-0.146	0.017	0.132

Table 4
Regression results: Dependent variable = intercepts of regional Beveridge curves

	coefficient	*standard error*	*coefficient*	*standard error*
unemployment rate	0.1158	0.0144	0.1203	0.0158
lagged unemployment rate	-	-	-0.0091	0.0134
long term unemployment	0.0065	0.0032	0.0088	0.0047
males under 20	0.0459	0.0292	0.0427	0.0296
females under 20	-0.0417	0.0186	-0.0395	0.0189
males over 50	-0.0141	0.0069	-0.0138	0.0070
females over 50	-0.0172	0.0109	-0.0156	0.0112

Table 5

Regression results: Dependent variable = log of unemployment rate, 1971-95

	coefficient	s.e.	shift
vacancy rate	-0.3332	0.0340	
1972	0.0668	0.0446	→
1973	-0.0605	0.0526	←
1974	-0.0543	0.0523	=
1975	0.1962	0.0447	→
1976	0.4229	0.0446	→
1977	0.5458	0.0449	→
1978	0.6237	0.0469	→
1980	0.6193	0.0445	=
1981	1.0639	0.0459	→
1982	1.3198	0.0446	→
1983	1.3216	0.0446	=
1984	1.3728	0.0447	=
1985	1.4145	0.0450	=
1986	1.3431	0.0461	(←)
1987	1.2784	0.0482	(←)
1988	1.0050	0.0489	←
1989	0.7154	0.0478	←
1990	0.5740	0.0458	←
1991	0.7591	0.0446	→
1992	0.9123	0.0448	→
1993	1.0107	0.0451	→
1994	0.9900	0.0451	=
1995	0.9217	0.0463	(←)
North	1.3494	0.0455	
Yorks. and Humb.	1.0171	0.0491	
East Midlands	0.8725	0.0462	
East Anglia	0.7711	0.0438	
South East	0.7518	0.0423	
South West	0.9629	0.0430	
West Midlands	0.9904	0.0495	
North West	1.1770	0.0472	
Wales	1.2598	0.0426	
Scotland	1.2987	0.0425	
R^2	.976		
Log-likelihood	231.60		

= , shift significant at less than 80% level. ( ), shift significant at 80-90% level. All others shifts significant at greater than 90% level.

Figure 1
u/v plot for Britain 1971-1995

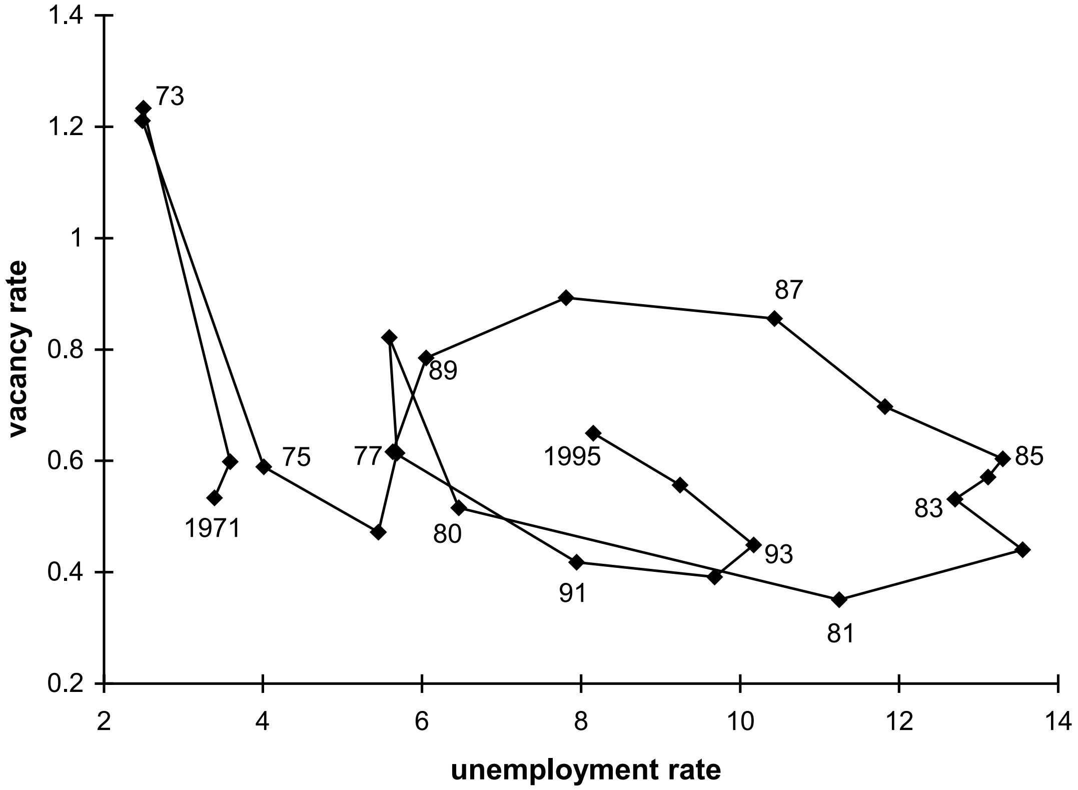

Figure 2
Shifts of regional and national Beveridge curves

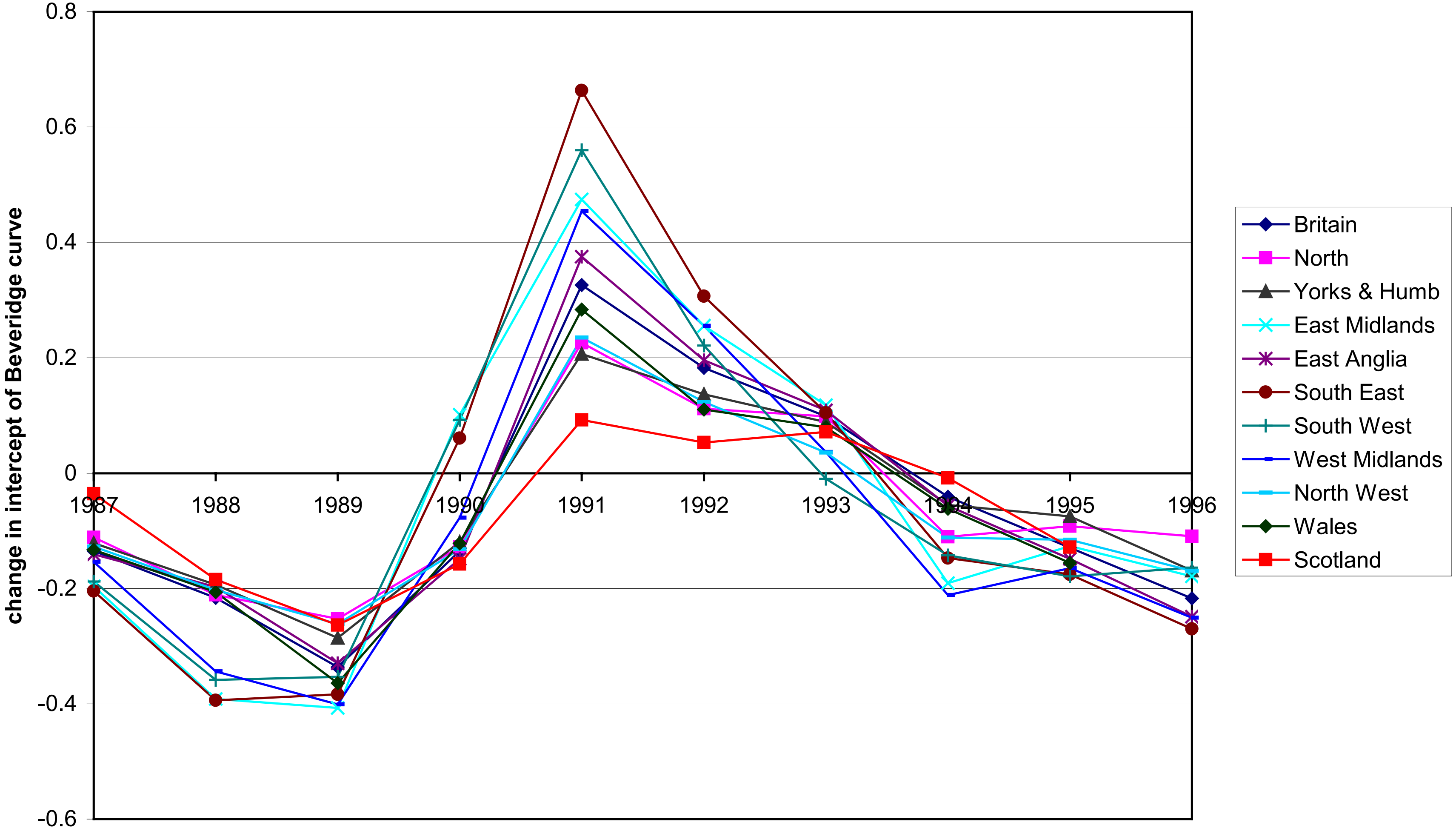

Figure 3
The Beveridge curve and the business cycle, 1986-95

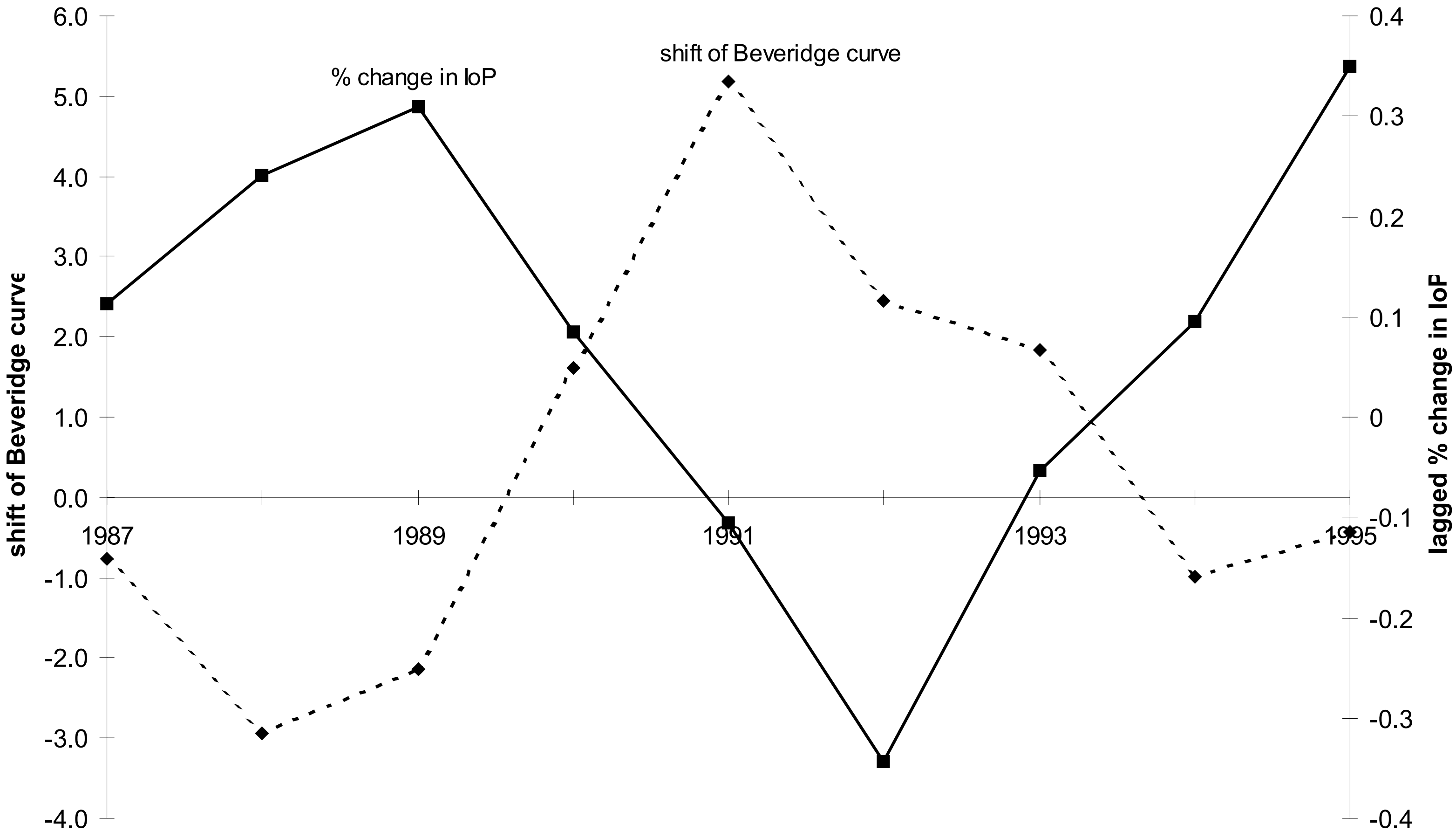

Figure 4
Shifts of the British Beveridge curve

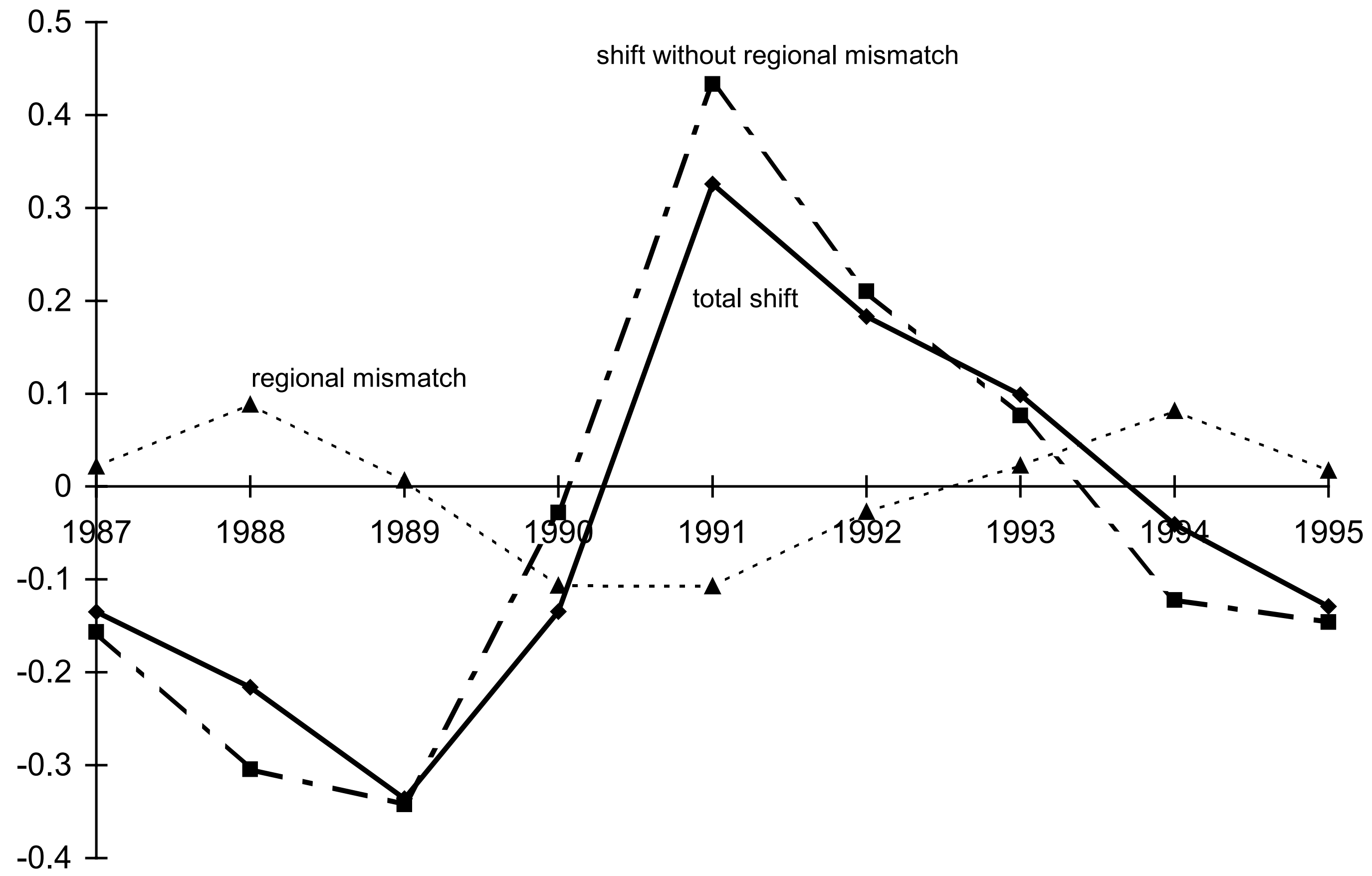

Figure 5
Intercepts of the British Beveridge curve

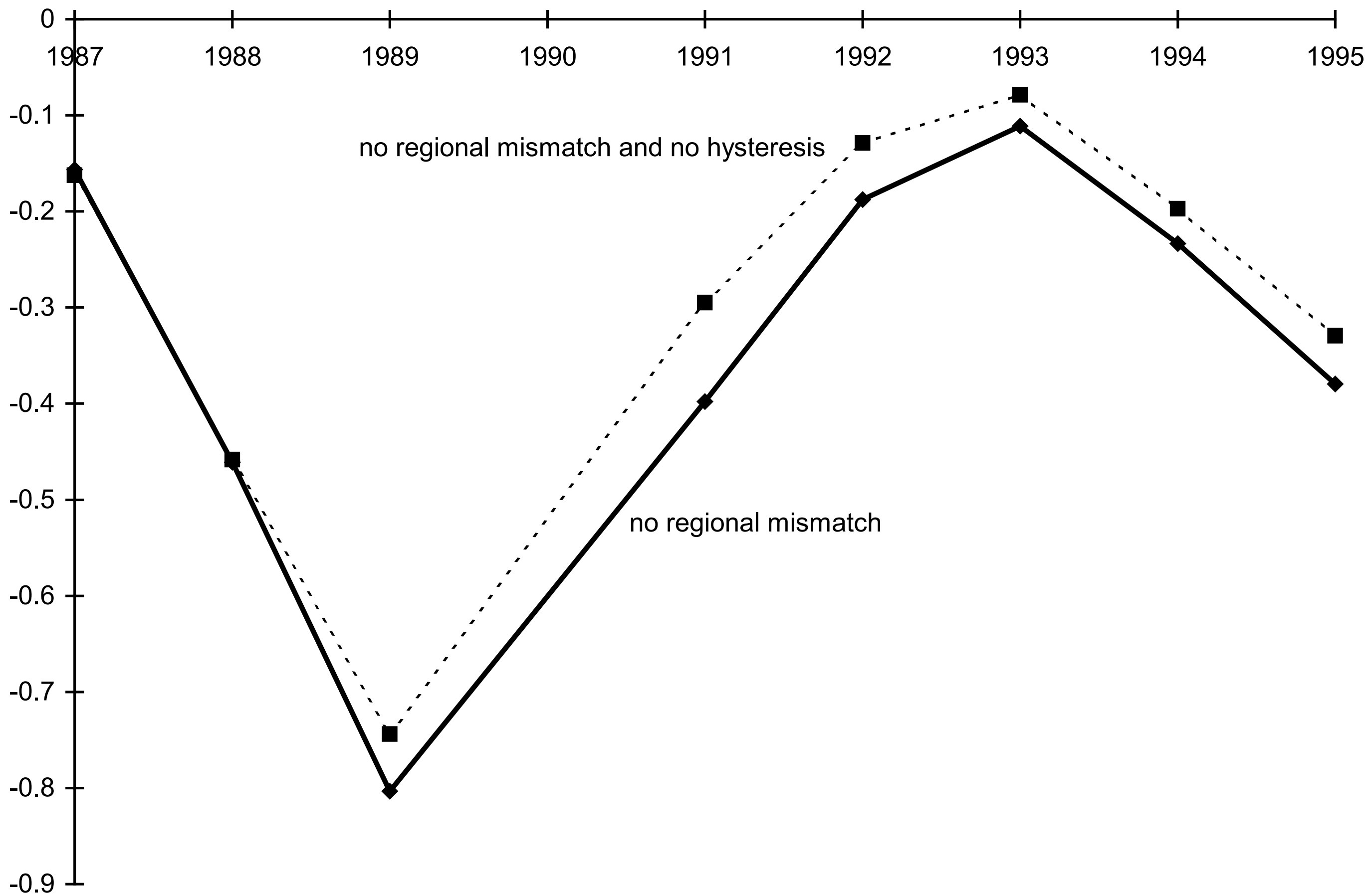

Figure 6
The Beveridge curve and the business cycle, 1971-95